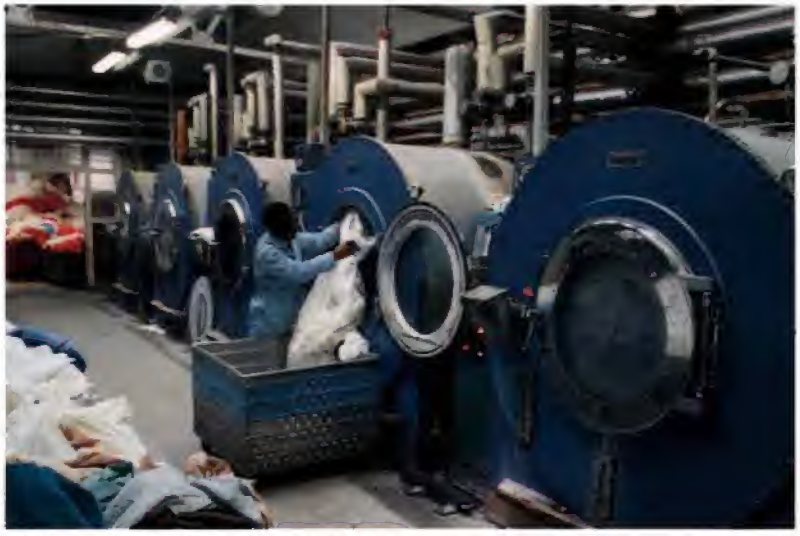
Case Study 60

Water and heat recovery in a hospital laundry



Washer extractors in the hospital laundry

Project Objective

To demonstrate the cost and energy savings which can be achieved by the use of a water recycling and heat recovery system in a laundry.

Potential Users

Commercial and hospital laundries.

Investment Cost

£19,000

Savings Achieved

Energy savings:	1,654 GJ/year £6,565/year
Water savings:	7,090 m^3/year £3,545/year
Net cost savings:	£9,864/year

Payback Period

1.9 years (all savings)

Case Study Summary

Washing and drying are the two basic processes in the fabric care industry; both are energy intensive. This case study examines the energy savings which can be achieved from a water recycling and heat recovery system installed in a hospital laundry. The system re-uses the comparatively clean discharged effluent from the last rinse of a washing cycle in the first wash process of the next cycle. By re-using the water and therefore the heat it contains, energy and water consumption can be reduced.

The laundry also makes use of flash steam by sparging it into the hot water tank. In addition to supplying the second wash with hot water, the heat recovery system provides enough hot water to enable the last rinse to be operated at 50°C. This reduces the retained moisture following hydro-extraction and the subsequent energy consumption in the drying and finishing processes. Overall, the project has demonstrated that the system generates considerable energy and cost savings, operates efficiently and requires little maintenance.

Host Organisation

District Laundry
Royal London Hospital
Whitechapel
London E1

Monitoring Contractor

Dyer Warner Partnership
Cliffe House
9 Church Hill
Birstall
Leicester LE4 4DN
Tel No: 0533 677017

BEST PRACTICE PROGRAMME

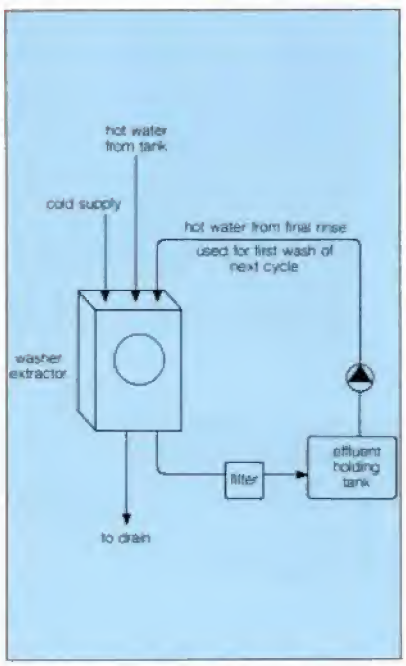
Energy Efficiency Office
DEPARTMENT OF THE ENVIRONMENT

"... the system, which requires very little maintenance, has paid for itself several times over and continues to generate significant savings."

Background

Commercial laundries fall into two main categories; smaller laundries equipped with traditional washer extractors processing up to 50,000 pieces/week, and larger laundries equipped with a combination of tunnel washers and washer extractors processing up to 200,000 pieces/week. Laundry is washed in a series of either hot or cold washes followed by a series of hot and cold rinses. After the washing process, the effluent is discharged to drain at temperatures ranging from 20 - 80°C.

Energy consumption can account for up to 20% of production costs, usually representing the second highest revenue cost after labour. Laundry management are keenly aware of this fact and that energy consumption is an area where savings can be made. There have been many developments in laundry equipment to reduce utility needs. Water recovery systems have been designed which are able to recover the relatively clean water from the last rinse of a cycle for use in the first wash of the next cycle. Heat may also be recovered from waste water which is too dirty for recycling and used to pre-heat incoming cold water through a heat exchanger. Both these systems require a multi-channel drain, multiple discharge valves for each machine to control the use of the effluent and additional effluent holding tanks.



Water and Heat Recovery System

Heat and Water Recovery at Whitechapel

The equipment at the Whitechapel laundry includes eight Spencer washer extractors, six tumble dryers, two calenders and various pressing equipment. The majority of the wash cycles at the laundry consist of four stages; two washes and two rinses. The wash process was modified in 1985 to enable the comparatively clean effluent from the final rinse to be collected, and re-used for the first wash of the next cycle. The alterations included the provision of discharge valves for each washing machine to enable the effluent from the final rinse to be directed to an effluent holding tank. The discharge valves are operated by a programme-card that controls the wash process.

Condense Receiver with Flash Vessel in Background

Reduced Water Consumption

The discharged effluent from the final rinse of each washing machine is directed to an effluent holding tank where it is filtered and pumped back to a washing machine when required. The first wash of the cycle is processed with water supplied at 35°C which is further heated by steam injection to 60°C within the machine.

The water consumption of each complete wash cycle is reduced by 250 litres in comparison to a similar system operating without an effluent recycling facility.

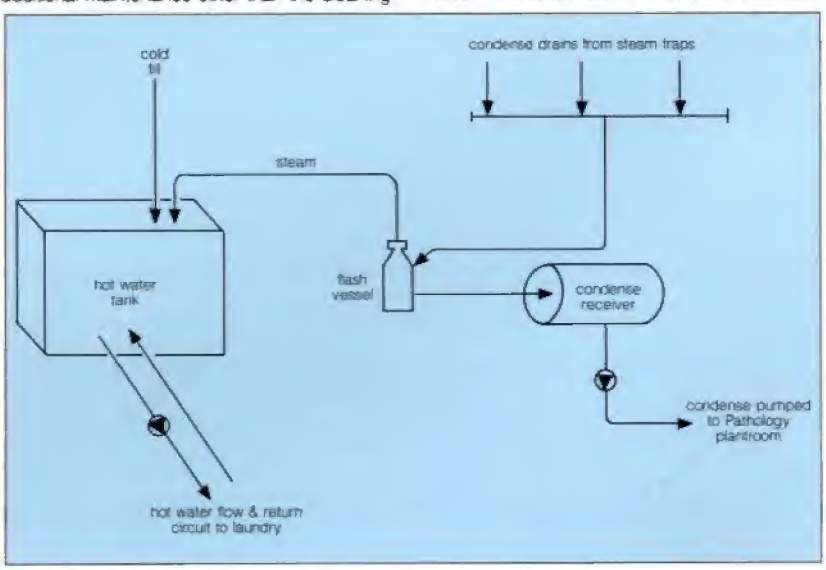
Maintenance of Heat Recovery System

The heat recovery system requires little additional maintenance other than the cleaning of the effluent filters each day.

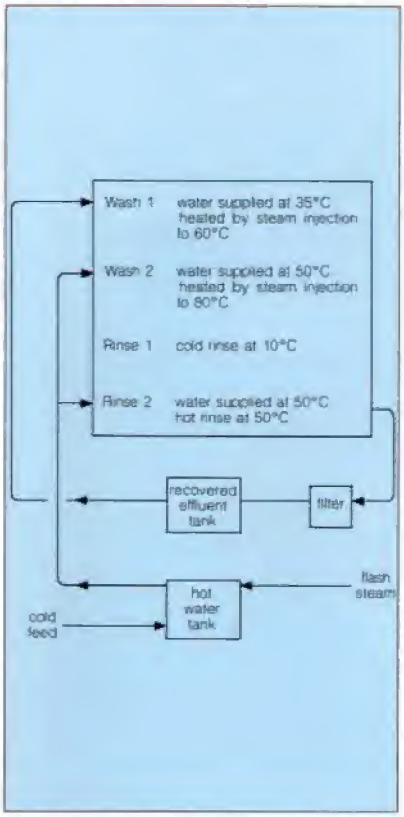
The discharged effluent from the final rinse is directed through a filter before entering the effluent holding tank. The effluent is then pumped from the effluent holding tank to the washing machines and used in the first wash cycle. The effluent passes through a fine metal mesh filter to remove any fibres from the washing process that would otherwise cause a blockage in the pumps or restricted flow in the pipework. The removal, cleaning and replacement of the filter requires one engineer for twenty minutes each day.

Flash Steam Recovery

Steam is supplied to the laundry at 6.2 bar (90 psi) on a ring main. The condensate from the steam lines is collected at steam traps and drained to a condensate receiver, via a flash vessel. The condensate is returned to the boiler



Flash Steam Recovery System



Wash Cycle with Heat Recovery

	With Heat and Water Recovery	Without Heat and Water Recovery
Workload (pieces/week)	44458	38126
Steam Consumption		
Washer Extractors		
(kg steam/piece)	0.460	0.658
(kg steam/kg work)	0.919	1.315
Calenders		
(kg steam/piece)	0.266	0.279
(kg steam/kg work)	0.531	0.558
Tumble Dryers		
(x kg steam/piece)	0.291	0.336
(x kg steam/kg work)	0.582	0.672
Total steam		
(kg/piece)	1.02	1.27
(kg steam/kg work)	2.03	2.54
Water consumption		
(litres/piece)	10.7	13.7
(litre water/kg work)	21	27

house, and the flash steam is sparged into the hot water tank.

The modification to the laundry plant room was carried out in 1985 to enable the hot water tank to be heated with flash steam. This replaced an arrangement of heat exchangers which was subject to distribution losses.

Benefits of Flash Steam Recovery

By recovering flash steam from the plant condensate return, the laundry is able to reduce its energy consumption considerably. This use of flash steam is more efficient than venting it to atmosphere. Another alternative to venting the flash steam to atmosphere is to return it to the main boiler plant with the condensate return. However, this is inefficient because it most likely vents to atmosphere at the hot well and increases the maintenance requirement on the condensate return pipes by inducing a degree of steam hammer and steam leaks.

The hot water generated by the flash steam recovery system is used to supply the final rinse with hot water in addition to supplying the second wash with hot water. Prior to the installation of the heat recovery scheme the final rinse was processed with cold water.

Operating the final rinse with hot water results in reduced drying times after the washing process. This is because less water is retained by the fabric following a hot final rinse than a cold rinse and therefore less energy is required to dry the laundry.

Energy and Water Savings

Using the heat recovery system has reduced steam usage in the laundry. The energy savings have been calculated to be 1,654 GJ/year and at a steam value of £3.97/GJ this gives annual energy savings of £6,565/year. This represents a reduction in steam consumption of 20%.

Energy savings are also realised in the reduced drying time within the tumble dryers which gives a reduction in steam and electrical consumption. For pieces not dried in the tumble dryers (ie cotton sheets) the energy savings are made in the reduced steam and electrical consumption of the calenders. Water retention tests and steam line sub-metering indicate that the benefit of performing the final rinse with hot water accounts for 24% of the steam savings.

The recycling of hot water reduces the water consumption of the laundry by 7,090 m^3/year. At a charge of 50p/m^3, this results in water savings of £3,545/year. This represents a reduction of 26%. A breakdown of energy consumption with and without the heat and water recovery system is given in the table. There is an energy saving of 76% in the washer extractors, 17% in the tumble dryers and 7% in the calenders.

There is a slight increase in electricity consumption associated with the heat recovery and the recycling of hot water caused by the electrical power consumed by the effluent pumps. The effluent pumps consume 4,095 kWh/year valued at £246/year. Taking this into account, the total savings from the installation of the system are £9,864/year.

Payback Period

The capital cost of the system was £19,000. The total project savings are calculated to be £9,864/year, producing a payback period of 1.9 years.

Effluent Holding Tank with Filter

Comments from Royal London Hospital

The two energy saving systems operating at the Whitechapel laundry demonstrate the considerable savings possible with conventional heat recovery projects. The recycling of the comparatively clean final rinse water from six washer-extractors saves not only energy but also water which is becoming an increasingly valuable resource. The laundry also provides a good example of flash steam recovery which is an established efficient practice. The laundry management is keenly aware of the need for conservation of resources, and monitors all energy and water consumption in conjunction with production. It is very satisfying to know that the system, which requires very little maintenance, has paid for itself several times over and continues to generate significant savings.

Ian Evans
Laundry Manager
Royal London Hospital

Royal London Hospital

The London Hospital has been established in Whitechapel since 1740 and has always been served by a laundry next to the hospital in buildings once used for the mortuary. The operation of the laundry is currently contract managed by PTMS 1988 Limited, and handles work from the London Hospital and Health Centres within the Tower Hamlets Health Authority. In addition to the heat recovery and water recycling system, there has been substantial investment in other energy efficiency systems at the laundry including plate heat exchangers on the tumble dryers, end point detection on the tumble dryers and hoods on both the calenders. The laundry employs 25 staff and operates from 07.30—16.30 five days per week. The amount of work handled has been stable for some time at around 45,000 pieces/week.

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